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6. Electrical. Provide lighting and two outlet receptacles in all manholes. See Electrical Design Criteria.

#### 2.3.14 Utilities

- a) All utilities shall be designed and constructed in accordance with FTW and the criteria contained herein. Steam and condensate return utilities shall be according to the Mechanical Design Criteria. Electric power lines and communication cables shall not be placed in the utilidor and shall be installed according to the Electrical Design Criteria. The materials and equipment to be furnished under this specification shall be the standard product of the manufacturer. Where two or more units of the same item, type, or class of equipment are supplied, these units shall be from a single manufacturer.
- b) The Contractor shall notify the Contracting Officer before a utility tie-in is required. See Appendix 13 for FTW SOP for utility outages. The notification shall be made a minimum of 10 days before tapping the line. Utility system shutdown(s) for tapping/tie-in(s) shall be made within a four (4) hour planned utility outage. The Contractor shall submit a work plan for utility tie-in/tap work prior to beginning the specified utility work. Connections between new work and existing utility mains shall be made with standard fittings, specials, using methods for on-site conditions and Manufacturers recommendations. The Contracting Officer shall approve the method of constructing connections under pressure before work begins. Contractor shall make provisions to provide temporary utilities to all facilities affected by outages longer than four (4) hours in duration.
- c) The Contractor shall design pipe anchors, thrust restraint, alignment guides, provisions for expansion/contraction and seismic restraint, type of joint (other than flange), pipe hanger or support for the pipe system and type of joints installed. The Contractor shall fully design these items, determining the number needed and the location of each.
- d) It is the Contractor's responsibility to design and construct all new mainline extensions and utility services for the new buildings.
- e) In addition to NPDES/Temporary Erosion and Pollution Control requirements, as specified herein, various elements of Post utility work may require ADEC review(s) and/or approval(s) in accordance with 18 AAC 80 and 18 AAC 72. If required, per the scope of the project improvements, Contractor shall confirm ADEC approval/permit requirements; submit and obtain all necessary ADEC approvals prior to beginning any work.
- f) Water Systems in Utilidors: Design shall include a full water supply system adequate to provide water for both domestic use and fire flow requirements. New hydrant flow testing shall be conducted by the Contractor to determine available fire flows at the proposed connection point.

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1. Fire hydrants. New hydrants shall be Kennedy or Waterous (both are FTW preferred brands). Two (2) new hydrants shall be installed at existing hydrant locations indicated.
2. Pipe. Pipe shall be ductile-iron or steel material. Changes in pipe sizes shall be made with reducing fittings. Use of long screws and bushings will not be permitted. Pipe and fittings connected to anchors shall be steel material.
  - a) Ductile iron pipe shall have asphalt coated exterior, cement-mortar lined interior, be rated for a 1,030-kPa working pressure, in accordance with AWWA C151.
  - b) Steel pipe shall be concrete lined in accordance with AWWA C200, with dimensional requirements as given in ASME B36.10 for pipe 150 mm in diameter and larger, and ASTM A 53 for smaller sizes. Pipe shall be Schedule 40, minimum. Pipe shall be cement-mortar lined and coated in accordance with AWWA C205.
3. Joints. Joints shall be flanged or mechanically coupled with rigid groove. Flexible grooved joints, or push-on or restrained push-on joint fittings are not allowed. Welded joints shall not be used except where other specified joints are not feasible. Welded joints shall be approved for each location required.
4. Expansion Joints. Contractor shall consider the expansion compensation impacts of connecting into existing mains and provide a design that addresses expansion effects on the new lateral as well as the existing main.
5. Valves. Isolation valves are required on all building service laterals, at all tees, crosses and fire hydrant legs. Provide a drain on the building side of the isolation valve. Valves shall be designed for a minimum working pressure of 1,030-kPa.
  - a) Check valves. Valves larger than 50 mm shall be iron body, bronze mounted, shall have flanged ends, and shall be the non-slam type.
  - b) Gate valves. Gate valves shall be iron body, bronze mounted, and the open screw and yoke (OS&Y) type.
  - c) Butterfly valves are prohibited.
  - d) Combination air valves. The valves shall be installed at all high points and where required.
6. Field coating of pipe and jointing. Defective areas in the coating and/or lining of pipe and joints shall be removed to the pipe wall, and repaired in a manner such that the repaired areas will be at least equal in thickness to the minimum coating and/or lining

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required for the pipe.

7. Pipe insulation and jacket system. The Contractor may propose the use of insulation materials and methods of installation other than those described. Approval of proposals for use of substitute materials and methods will be given only if sufficient evidence is presented, with the request for their use, to demonstrate their durability and functional adequacy in every respect. Approval will not be granted for use of any substitute materials or methods which permit the permeation of water vapor into or through the insulation or through the insulation joints, or which will not withstand 95 degrees C minimum temperature without damage. The Contractor shall furnish, along with any proposal, a detailed estimate showing the difference in cost between the alternative proposed and the materials and methods delineated herein:

Insulation. Cold water lines, including valves and fittings, throughout utilidors shall be covered with either extruded polystyrene, polyurethane and/or polyisocyanurate insulation. Insulation in manholes and other accessible areas shall be covered with an aluminum jacket (other options not allowed) with vapor barrier.

8. Pipe hangers, inserts and supports. The Contractor shall submit design calculations showing the adequacy of the pipe support system which shall be as recommended by the pipe manufacturer. Supports shall be slotted to prevent the accumulation of liquid where water lines and sewer lines are placed on the same support. All supports shall have an extra heavy galvanized coating and the bottom 12" of each support leg shall be coated with a coal tar coating.
9. Provide alignment guides and anchors to adequately support the pipe and prevent distortion and binding
10. Pipe slide plates. Plates shall be graphite or polytetrafluoroethylene (PTFE) Teflon.
11. Anchors and Thrust Restraint.

- a) Anchors. Pipe system anchors in manholes and utilidors shall be of welded construction.
- b) Thrust Blocking. Plugs, caps, tees and bends on all waterlines 100 mm in diameter or larger, and on fire hydrants, shall be provided with concrete or structural steel thrust blocking, anchors or metal tie rods and clamps or lugs as required by NFPA Code. Valves shall be securely anchored or shall be provided with thrust blocking to prevent movement. . Blocking shall be placed so that the fitting joints will be accessible for repair. The connection between the utilidor water or fire lines and the interior building water, and all bends, plugs and tees on fire protection lines,

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shall be installed and restrained against thrust in accordance with NFPA 24. Steel rods, clamps and other restraint devices shall be protected against corrosion by methods acceptable for the adjacent environment.

12. Hydrostatic Test. After the pipe system is completed, the newly laid piping or any valved section of water piping or fire line shall be subjected to a hydrostatic pressure test. Test shall be for a period 2-hours with a pressure of 1,380-kPa, or 1.33 times the working pressure, whichever is greater. Each valve shall be opened and closed several times during the test. Exposed pipe, joints, fittings, valves and hydrants shall be carefully examined during the test. No leakage will be allowed. Joints showing visible leakage shall be replaced or remade as necessary.
13. Disinfection. Before acceptance of potable water operation, each unit of completed water and fire line shall be disinfected as prescribed by AWWA C651. The unit will not be accepted until satisfactory results have been obtained from water samples submitted by the Contractor to a laboratory certified by the State of Alaska to perform testing for coliform bacteria. Chlorinated water shall not be discharged to the environment. The Contracting Officer shall approve the method proposed for disposal of wastewater from disinfection before beginning the process.

- g) Sewers in Utilidors. The sewer system shall meet the most stringent requirements of those in 18 AAC 72, TM 5-814-1, TM 5-814-2, or the National Standard Plumbing Code. Tapping into existing systems shall be accomplished in accordance with FTW, with maximum utility outages as specified in paragraph 2.3.14b of this section. Sewers in utilidors shall be in accordance with the applicable provisions of paragraph denoting Water Systems In Utilidors except as modified herein:
1. Combination Sewage Air Valves. Provide as required.
  2. Expansion Joints-Sewer. Expansion joints in sewer force mains shall be grooved pipe type couplings permitting 50 mm minimum of pipe movement. Expansion joints shall be designed for a minimum working pressure of 1,030 kPa. Bellows Type joints shall not be used.
  3. Piping for sewer lines shall be ductile iron or steel. Minimum size for sewer laterals shall be 150 mm and meet minimum flow requirements in stated references. Size of gravity sewer mains shall be of adequate capacity and meet minimum flow requirements in stated references. The minimum working pressure shall be 1,030-kPa for forced main sewer and 345-kPa for gravity sewer.
  4. Cleanouts. Provide Y-style cleanouts at all utilidor manholes. Orient cleanout in opposite direction of flow.
  5. Insulation and Jacketing. Not required.

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6. Disinfection. Not required.

#### 2.3.15 Miscellaneous

- a) Dumpster Storage Area. Provide a screened concrete centrally located dumpster storage pad with adequate room for dumpster loading truck access. Dumpster pad shall be reinforced concrete sized for twenty (20) standard size dumpster of the type used at the Post. At a minimum, screening shall be chain link fencing with privacy slats. Provide on offset chain link gate with slats to allow personnel access and visual screening with gate closed and truck access when gate is open. Vehicle access to the pad shall be designed for a standard garbage truck and shall be asphalt surfaced as described for roads and parking lots. Dumpster storage area shall be located a minimum of 25 m from any building.
- b) Electrical Transformer Pad. The electrical service pad mounted transformer is to be screened with an architectural screen that blends aesthetically with the facility. A chain link gate with vertical slats for visual screening shall provide maintenance access.
- c) Signs. Provide street and building signs in accordance with FTW standards. Provide street signage, including traffic control and street names along Chestnut Street extension. Provide building and parking area identification signs at all buildings.

#### 2.3.16 Betterments

The following betterments as listed in paragraph 1.1 GENERAL REQUIREMENTS shall conform to the criteria outlined above:

- 1. Additional off-street parking.
- 2. Fencing for Individual Residential Units.

#### 2.3.17 Design/Build Contractor Innovations

All Design/Build Contractor innovations shall conform to the performance criteria outlined above.

#### 2.3.18 Prohibited Items

Prohibited items shall be those that do not meet the minimum requirements already listed.

- 1. Utility service laterals in anything other than concrete utilidors.
- 2. Pre-engineered "Arctic Pipe" utility system.
- 3. HDPE pipe.
- 4. Mounting of structural element, equipment, piping, or conduit to removable utilidor or manhole lids.

#### 2.4 ARCHITECTURAL DESIGN CRITERIA

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#### 2.4.1 Overall Building Design and Building Systems

- a) Construction Summary.
  - 1. Seismic Zone 3.
  - 2. Construction Type - UBC Type V (per Mil-HDBK-1008C, Section 2.1.3a).
  - 3. Automatic Sprinkler Protection - required in buildings greater than duplex structures (MIL-HDBK-1008C, Section 4.2.2). Area separation walls shall be utilized to preclude the need for a residential sprinkler system.
- b) Occupancy - R-3.
  - 1. Handicap accessibility - 5 percent of total (4 units).
  - 2. Sound Attenuation - see Room Criteria Sheets.
  - 3. Roof System - NR (non-rated) per UBC Table 15-A.
- c) This base housing revitalization project includes the hazardous materials abatement and demolition of 12 buildings in two neighborhoods in Fort Wainwright: building numbers 1014, 1027, 1028, 1029, 1030, 1038, and 1039 in the North Town neighborhood and building numbers 4129, 4130, 4133, 4134, 4139 in the Southern Cross neighborhood. At the offeror's option, new building design may utilize existing foundations and basement spaces. Basement area will be considered bonus, and not counted as part of program space. Other demolition criteria and protocol for utility connections and pavement areas are described in Civil Design Criteria section 2.3.
- d) Demolished units are replaced by new construction for Company Grade/Warrant Officers: forty 3-bedroom and thirty-five 4-bedroom units. As detailed in the Room Criteria Sheets, the maximum total net area for 3-bedroom units is 125 square meters (1,350 square feet), plus 27.87 square meters (300 square feet) "Arctic Bonus" indoor activity area. The maximum total net area for 4-bedroom units is 135 square meters (1,450 square feet), plus 27.87 square meters (300 square feet) "Arctic Bonus" indoor activity area. Net area excludes exterior walls, half the thickness of interior walls adjacent to excluded areas, utility and laundry rooms, interior and exterior bulk storage, washer/dryer closet, mechanical equipment space, stairs and landings, vestibules, attic and basement, patios and balconies, garage, and area increases required to meet accessibility standards. Minimum areas for individual spaces are also listed in the Room Criteria Sheets.
- e) Four handicap accessible 3-bedroom units will be designed as readily adaptable to accommodate residents with physical impairments. A readily adaptable unit is one that can be converted to fully accessible standards for less than \$12,000 (in 2001 dollars). Access clearances, room sizes, bathroom and kitchen layouts, and door openings will be

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designed and built to accessible standards. Kitchen and vanity cabinets shall be of standard configuration. Wood blocking for future grab bars shall be provided. Design readily adaptable space for future wheelchair lift to accommodate access to all floor levels, except basements and garages. Handicap accessible units may be located together in one building or interspersed in the different buildings.

- f) Force protection is categorized a minimal risk for this project. Refer to each discipline's technical requirements for respective force protection criteria. Exterior doors will be equipped with a dead bolt with a minimum of one-inch throw. Any glazing used in doors will be sufficiently small and/or located in a part of the door that would preclude a person from breaking the glazing, reaching through, and operating the dead bolt. Additionally, windows at the sides of the doors that would allow breakage and reaching through to the deadbolt are prohibited. If exterior main entrance door is not equipped with transparent glazing, it shall include a "peep hole".
- g) Acoustical design of building walls and partitions will meet or exceed the minimum criteria defined in the Room Criteria Sheets area for all program areas. FIIC 57 (Field Impact Isolation Class), and FSTC 52 (Field Sound Transmission Class). Telephone, cable, outlets, ducts, and any other penetrations must not compromise acoustical integrity of wall assemblies. Offerors are encouraged to use acoustical and space planning to minimize intrusive exterior noise, noise between units, and noise transfer within units.
- h) Exterior building materials will be selected for their zero-maintenance and climate resistant characteristics. Unit plan layouts may be the same or similar, however, the exterior form shall vary for visual interest among adjacent units, while conforming to base standards for material and color scheme requirements. The buildings should have a strong residential identity as part of its "street appeal", the garage shall not dominate the street frontage. A boxy aesthetic shall be avoided. Acceptable exterior building finishes (within TI 802-02 parameters) include brick and factory-prefinished vinyl siding. EIFS exterior finish is not considered a zero-maintenance finish. No exterior materials shall require painting or regular maintenance.
- i) Natural lighting shall be designed to enhance all interior spaces. While not mandatory, natural lighting can benefit spaces such as: garage, bathrooms, and laundry, with due consideration of climate, moisture, privacy, and security concerns.

#### 2.4.2 Building Shell Construction

- a) The following descriptions of specific building elements are considered minimum requirements. IECC and BEES



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prescriptive R-values for the Fairbanks area are noted here in imperial units. IECC R-values include the net effects of framing, other materials, and air films, whereas BEES values are for insulation only.

1. Walls: IECC - 26, BEES - 25.
  2. Windows: IECC - 4, BEES - 3.
  3. Roof/Ceiling: IECC - 38, BEES - 38.
  4. Doors: IECC - 5, BEES - 7.
  5. Floors over unheated space: IECC - 20, BEES - 38.
  6. Heated slab on grade: IECC - 16, BEES 15.
  7. Unheated slab on grade: IECC - 11, BEES - none indicated.
  8. Basement walls: IECC - 17, BEES - 19.
  9. Crawlspace walls: IECC - 17, BEES - 19.
- b) Exterior wall assembly: exterior finish material, infiltration barrier, 13 mm plywood sheathing, minimum 3.3 M<sup>2</sup>-K/W (R19) fiberglass batt insulation, continuous 8-mil vapor retarder at the warm side of the insulation, and 16 mm (type "X" where required) gypsum wallboard interior wall finish. Provide properly located expansion joints suitable for exterior and interior application to effectively control expansion and contraction of building materials. Coordinate visible control joint locations with structural design and finish materials.
- c) Foundations shall be cast in place or concrete masonry unit with insulated/vapor retarder applied, ventilated crawl space, and waterproofed appropriately for the soil conditions. Foundations found suitable for reuse shall be repaired as needed and waterproofed. Roof drainage and grading shall direct all surface water away from foundations.
- d) All vapor retarder shall have edges and joints taped with 75 mm wide vapor retarder tape per manufacturer recommendations. Joints, penetrations, fastener penetrations, laps and interfaces with floor or ceiling shall be sealed with minimum of 6.35mm wide bead of Tremco brand acoustical sealant or approved equal per manufacturer's instructions. Sealant application on laps shall occur on studs or other solid surface. At electrical boxes, vapor retarder shall be continuous behind the box with conduit or other penetrations sealed with acoustical sealant. Use "Elastomeric Sealant" classification appropriate for the applications in which it is being used. Custom colors are required where sealant is installed matching finished adjoining surfaces.
- e) Walls between units, area separation walls, garages, and mechanical rooms shall be designed and constructed to fire ratings defined by code, and to acoustical requirements defined by area in the Room Criteria Sheets. Rounded outside corner beads and light orange peel texture are required for this project. Industry standards for fire ratings, application, and finishing shall be in accordance



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with Gypsum Association and Underwriters Laboratory.  
Minimum requirements for interior walls are as follows:

1. Non-Bearing Partitions - 40 mm x 90 mm studs @ 406 mm o.c. with 1 layer 16 mm gypsum wall board each side.
2. Walls Between Units - double row of 40 mm x 140 mm wood studs at 406 mm o.c. staggered, 16mm gypsum wall board each side to UL fire resistance requirements.
3. Moisture resistant gypsum wall board shall be used in damp area walls.

- f) Windows shall be tilt-turn type PVC thermally broken frames with double-glazing and interior Low-E film - U value of .31, conforming to the requirements of ANSI/AAMA 101-97 GRADE C70. In addition, glazing and frame shall be manufactured to incorporate "Force Protection" elements against glass fragments being released toward the interior side of the window (refer to the Force Protection Standards in the Appendices). Laminated shatter resistant tempered glass is required. Window frames and sashes shall be of sufficient strength to retain the glazing panels in the structure during a medium blast event. Frames shall be of sufficient strength to retain the glazing panels in the structure. Windows shall be classified in accordance with AAMA/NWWDA 101/1.S.2-97. All fixed windows shall conform to F-AW40. Sleeping area windows shall be operable and screened, and shall meet egress requirements. Bay windows and window seats are desirable in Dining Room and/or Family Room.
- g) Roof Assembly shall be ventilated "cold" system with minimum insulation R-value of 6.69 (M<sup>2</sup>-K)/W, 8 mil continuous vapor retarder, and shall have a minimum 4:12 ratio pitch. Drainage shall divert snow and ice away from building entrances and patios. Design of roof eaves and other elements shall prevent birds' entry during and after construction. The primary roof is ventilated cold roof sloped minimum 4:12, asphalt roof shingles with 15# roofing felt, Ice & Water shield @ eaves and valleys, and plywood roof sheathing. Gutters and downspouts shall be used to direct roof drainage away from the building entrances and foundation.
- h) Roof system shall be NR (non-rated - as defined by the Uniform Building Code), and warranted by the Contractor against material and workmanship deficiencies. These include but are not limited to system deterioration caused by ordinary exposure to the elements, water leaks, and wind uplift damage of 90 UL 580 Class rating, on a no penal sum basis for ten (10) years after project completion. This warranty shall cover the entire cost of repair or replacement, including all material, labor, and related markups.
- i) Interior floor assembly shall be of minimum 28 mm thick tongue-and-groove plywood, supported by prefabricated wood joists. Garage floors shall be reinforced concrete slab on

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grade.

- j) Doors: All exterior door hardware backsets shall allow a thick, gloved hand to operate the keying.
  - 1. Unit entry shall be designed and illuminated to promote a clear sense of arrival. Provide insulated 20 gauge steel skin panel door with a baked-on polyester finish.
  - 2. Exterior utility doors shall be insulated heavy-duty hollow metal meeting ANSI A250.8 (Grade II) with thermally broken hollow metal frames.
  - 3. Interior doors shall be 2050 mm (6 feet, 8 inches) high by 35 mm (1-3/8 inches) thick, solid panel doors.
  - 4. Garage sectional overhead doors shall match the unit entry in appearance and material, glazed panels are prohibited. Provide a baked-on polyester finish, nominal 20 gauge galvanized steel exterior cover, 26 gauge back cover, minimum; with isocyanurate insulation (R-value 11.69 minimum), weatherstripping, jamb seals, bottom sensing edge, and windload resistance per Wind Exposure C classification.
- k) Door Hardware: Provide complete hardware sets appropriate to the functions required. Door locks and cylinders shall be 7-pin, (Main Entry access and exterior utility doors only) and provided with weather stripping, thermally broken thresholds, and wall-mounted or overhead mounted doorstops, which allow the door swing to avoid contact with adjacent walls or other building elements. Hardware sets must comply with fire-rating required between residential unit and attached garages. Patio doors shall include a flush bolt. Cylinders from "Best Lock Company" are required.
- l) Exterior signage shall be provided to meet FTR/FTW Installation Design Guide Signage shall be integrated into the building and site design in an attractive manner.
- m) At exterior windows and doors, wall louvers, roof vents and other miscellaneous penetrations through the exterior envelope, flashings, backer rods, sealants, and caulks shall be provided which properly contain irregular forms, recesses, and grooves weathertight. Sealants shall be either concealed from UV exposure or of the type not susceptible to UV degradation.
- n) Mail boxes are not provided in this contract.
- o) Exterior color scheme shall conform to the Ft. Wainwright Family Housing Community Plan as follows: Windsor Blue - match Sherwin Williams #BC1848 or ICI-2C11-4; and Antique Parchment - match Sherwin Williams #1851 or ICI-1C20-2.

#### 2.4.3 Interior Construction

- a) Access panels or doors shall be provided in walls, floors or ceilings to access all plumbing, mechanical and

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electrical items expected to require maintenance such as trap primers, water hammer arrestors, shut-off valves, and control valves. Placement of panels and orientation of fixtures shall be coordinated so as to minimize visual impact while providing adequate access to equipment being serviced. Size access panels so that two-handed work can be easily accomplished. See Mechanical, Section 2.6.4(b) for additional access requirements.

- b) Bathrooms may be designed with a separate compartment for the toilet and bath, so family members can use the sink(s) while the separate compartment is occupied.
- c) Ceilings shall be 2400 mm (8 feet) minimum height, exceeding the 2300 mm (7 feet, 6 inches) minimum in the AEI standards. Living rooms shall be a high ceiling area with a feature window configuration facing the street. Master bedrooms may have a scissor truss ceiling configuration, maintaining ventilated cold-roof construction.
- d) All toilet accessories shall be mounted to concealed backing. Accessories shall include at a minimum: clothes hooks, towel bars, grab bars, toilet paper dispenser, mirrors and medicine cabinets, shower rod, and soap dishes for each bath/shower compartment.
- e) Fire extinguishers are not required as part of this contract.

#### 2.4.4 Interior Design and Finishes

- a) Select neutral colors for surfaces that will have a long life, such as ceramic tile, laminates, window blinds, etc., and use accent colors in a variety of textures for non-permanent finishes to add interest and vitality. The interior design must be integrally related to the overall architectural scheme. The design and design review shall be accomplished by, or in consultation with, professional interior designers and architects
- b) Interior colors for painted surfaces and factory finished items shall conform to the guidelines set forth in the Ft. Wainwright Family Housing Community Plan (see appendix).
- c) Resilient sheet flooring, vinyl or linoleum, shall be commercial quality with a full-depth color and pattern with a minimum radiant flux of .45 watts per square centimeter and tested in accordance with ASTM E-648. Flooring shall be heat sealed at seams. The color selected should be easily maintained and neat looking between cleanings.
- d) Exposed concrete slabs shall receive clear sealer.
- e) Wall Base shall be 100 mm-rubber cove, ceramic tile, or wood per Room Criteria Sheets. Vinyl base is prohibited. Color match rubber base to transition strips. Do not install rubber resilient base in conjunction with ceramic,

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quarry or other similar hard tile surfaces.

- f) Carpet shall be first quality 100 percent nylon broadloom having a gauge of 3.175 mm per ASTM d 418, 8 stitches or rows per square inch, a finished pile yarn weight of 28 ounces. And pile density of 7000 ounces. Carpet shall be solution dyed, tufted, durable, inherently soil and stain resistant, and have permanent static control properties. Primary backing material shall be polypropylene. Maximum allowed static build up of 2kv when tested at a 20 percent relative humidity and 21 degrees C. Installation shall be in accordance with the Carpet and Rug Institute CRI 104 and with a minimum radiant flux of .45 watts per square centimeter and tested in accordance with ASTM E-648.
- g) Carpet pad shall be "PL Series" by Fairmont (#PL2210), or a similar product with the following characteristics: 10# density rated for heavy commercial traffic, .220mm thickness, .40 NRC sound absorption, 71 IIC (impact insulation class), compression load deflection (per D-1564-69): 5.3 min. psi (25% deflection), 35.3 minimum psi (65% deflection); 6.7 modulus; Flammability - Class A Rating, passes DOC-FF-1-70 pill test, ASTM E-84 Flame spread rating - 25, and passes ASTM-E-662 smoke density test. Covering resists spill seep-through, and can be installed in double-glue down application or conventional method.
- h) Wainscots may be used in unit public areas to provide lower wall protection and aesthetic value. Offerors may propose creative solutions, and designs will be evaluated based on appearance and durability. Room Criteria Sheets do not indicate areas requiring wainscots it is the Offeror's option to design to the project's benefit.
- i) Paint typically shall be eggshell or satin latex enamel, except at accent walls where flat finish may be used, and except at bathrooms and kitchens where semi-gloss is required. Provide 3-coat application consisting of one primer coat and two finish coats and provide complete hiding. All coatings shall be factory formulated and recommended by the manufacturer for the application indicated. Provide block fillers, primers, and finish-coat materials that are compatible with one another and with the substrates for the intended use. Finishes shall be durable, scrub able, and resistant to scuffs and fingerprints.
- j) Casework and cabinets shall be well constructed of high-density plastic laminate with sturdy hardware and built according to "Premium grade" standards of the "Architectural Woodwork Quality Standards 7<sup>th</sup> Edition Version 1.2 1999". Casework joints, connections, hardware and finish shall be constructed to withstand high abuse. Extend wall cabinets to finish ceiling, without enclosed soffits, for additional storage capacity. Provide lazy-susan corner cabinets, and "breakfast bar" countertop with kneespace. Provide oversize drawers in base cabinets to

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accommodate cooking pots.

- k) Countertops shall be scribed to fit opening and constructed of solid surface cast polymer (Betterment) or high-pressure decorative laminate meeting the "Architectural Woodwork Quality Standards 7<sup>th</sup> Edition Version 1.2 1999". Backsplashes, countertops, and edges shall be one-piece construction. Waterfall or bullnose countertops are preferred. While not mandatory, a heat-resistant (such as impact/heat resistant glass) area adjacent to the range is desirable. Integral cutting boards are not acceptable for this purpose.
- l) Miscellaneous shelving to be constructed of 19 mm (3/4 inch) A/B grade birch plywood with clear or painted finish, and shall be supported by adjustable double slot heavy duty steel brackets on wall standards. Use matching wood edge banding on all edges.
- m) Wood door casings, window casings, and base trim receiving a clear finish shall be clear-grained hardwood in a profile that is resistant to collecting dirt and dust. Clear natural finish or paint finish shall be satin gloss. All coatings shall be factory formulated and recommended by the manufacturer for the application indicated. Provide block fillers, primers, and finish-coat materials that are compatible with one another and with the substrates for the intended use. Finishes shall be durable, scrub able, and resistant to scuffs and fingerprints.
- n) Window blinds shall comply with AWCMA Document 1029 as self-leveling, consisting of louver slats, rails, ladders, tapes, lifting/tilting mechanisms, cord/cord-lock, tilt control, and installation hardware. Cords shall be designed to comply with current child-safety industry standards.

#### 2.4.5 Betterments

The following betterments as listed in paragraph 1.1 GENERAL REQUIREMENTS shall conform to the criteria outlined above.

- 1. Solid surface countertops at vanities and kitchens.
- 2. Ceilings higher than 7 feet, 6 inches AEI minimum criteria.

#### 2.4.6 Design/Build Contractor Innovations

All Design/Build Contractor innovations shall conform to the performance criteria outlined in this section.

#### 2.4.7 Prohibited Items

The following items are prohibited from inclusion in proposals:

- 1. "Northern" brand PVC windows.
- 2. FRT plywood in any part of the roofing system. FRT may only be used in non-structural applications that

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- are not subject to elevated temperatures or high humidity.
3. Spray or blown-in insulation.
  4. Access to roof by exterior ladder or stair.
  5. Pinch-pleated draperies.
  6. Recessed medicine cabinets.
  7. Particle board in cabinetry or shelving.
  8. Hardboard and cement asbestos shingle siding.
  9. Painted exterior elements.
  10. Wood exterior trim requiring maintenance.
  11. Iron or galvanized steel exterior handrails.
  12. Flat roofs, membrane roofing.
  13. EIFS exterior finish.
  14. Fireplaces.
  15. Wood flooring.
  16. Bifold closet doors with slats.
  17. Hollow core doors.
  18. Vinyl wall base.

## 2.5 STRUCTURAL DESIGN CRITERIA

### 2.5.1 References

Structural design and design documents shall be in accordance with the following codes and regulations, and shall conform to the standards recognized by the codes and regulations. If dates are not given for reference standards or criteria, the latest edition is to be used. Where reference is specifically made from this narrative to other sections of the overall "Request for Proposal" document or from other sections to this section, the criteria stated here in this section shall govern. Specific design loads, the materials, the strength and quality of the materials indicated here in shall be considered minimums. If design loads, material(s) or materials(s) as components of a system are not specifically prohibited from the project and they meet the requirements of the specified codes, they may be included in the project. Structural design shall be provided for elements that are not part of the structural system, but provide support for other facility system(s).

1. American Association of State Highway and Transportation Officials (AASHTO).
2. American Concrete Institute:
  - ACI 318 Building Code Requirements for Structural Concrete and Commentary.
  - ACI 315 Manual of Standard Practice for Detailing Reinforced Concrete Structures.
  - ACI Manual of Concrete Practice, Part 1 through Part 5.
3. American Forest & Paper Association:
  - AF&PA-NDS National Design Specification for wood.
4. American Institute of Steel Construction:
  - AISC ASD 9th Ed., Allowable Stress Design, Manual of Steel Construction.
  - AISC LRFD 2nd Ed., Load & Resistance Factor Design Specification for Structural Steel Buildings and Manual of Steel

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- Construction.
5. American Institute of Timber Construction:  
AITC Timber Construction Manual, 4th Ed.
6. American Iron and Steel Institute:  
AISI Cold Formed Steel Design Manual.
7. American National Standards Institute/American  
Welding Society:  
ANSI/AWS D1.1, Structural Welding Code - Steel.
8. American National Standards Institute/American  
Society of Civil Engineers:  
ANSI/ASCE, Minimum Design Loads for Buildings and  
Other Structures (ASCE 7).  
ANSI B30.16 Overhead Hoist.
9. American Plywood Association:  
APA Design/Construction Guides.
10. Federal Emergency Management Agency, National  
Earthquake Hazards Reduction Program:  
FEMA, NEHRP, Recommended Provisions for the  
Development of Seismic Regulations for New Buildings,  
Part 1 - Provisions, Part 2 - Commentary.
11. International Conference of Building Officials  
ICBO Uniform Building Code (UBC), 1997  
edition.
12. National Concrete Masonry Association Publications.
13. Masonry Institute of America Publications.
14. Steel Deck Institute:  
SDI Design Manual and Diaphragm Design Manual.
15. Steel Joist Institute:  
SJI, Standard Specifications, Load Tables and Weight  
Tables for Steel Joists and Joist Girders.
16. Truss Plate Institute:  
TPI Manuals for design and fabrication of wood  
trusses.
17. Military Design Manuals (DM), Technical Instructions  
(TI), Engineering Instructions (EI), Technical  
Letters (TL) and Technical Manuals (TM):  
TI 800-01 Design Criteria.  
TI 809-01 Load Assumptions for Buildings.  
TI 809-02 (TM 5-809-2) Structural Design Criteria  
for Buildings.  
TI 809-04 Seismic Design for Buildings.  
TI 809-06 (TM 5-809-3) Masonry Structural Design  
for Buildings.  
TI 809-26 (TM 805-7) Welding - Design Procedures  
and Inspections.  
TI 809-29 Structural Considerations for Metal  
Roofing.  
TI 809-30 Metal Building systems.  
TI 809-52 Commentary on Snow Loads.

#### 2.5.2 General Information

- a) The Design-Build Contractor's Structural Engineer of Record shall be responsible for the design of the complete structural system for the buildings. Complete structural system for the buildings shall include foundations, walls, roof framing, floor and roof diaphragms, lateral load



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stability, framing and connection of any architectural features, and support and bracing of mechanical and electrical related structures, although they may be shown on other disciplines' drawings. The structural engineer is also responsible for the design of all lesser structures. Related structural design shall be compatible with the architectural design. The structural design drawings and calculations shall be sealed by the engineer in responsible charge. The engineer shall be licensed as a civil engineer in the State of Alaska.

- b) If the existing foundations are to be reused for the new construction, a complete structural investigation and analysis shall be required of each foundation to remain. The Structural Engineer of Record shall verify that the foundations are in sound condition and capable of supporting all loads from the new construction.

#### 2.5.3 Minimum requirements

- a) All buildings must have complete gravity and lateral force resisting structural systems. Any system or method of construction to be used shall be based on a rational analysis in accordance with well-established principles of mechanics. Such analysis shall result in a system that provides a complete load path capable of transferring all loads and forces from their point of origin to the load-resisting elements.
- b) The building systems shall be capable of withstanding design forces from wind and earthquake loading. The total lateral force shall be distributed to the various vertical elements of the lateral force resisting system in proportion to their rigidities considering the rigidity of the horizontal bracing system or diaphragm. Rigid elements that are assumed not to be part of the lateral force resisting system may be incorporated in buildings, provided that their effect on the action of the system is considered and provided for in the design. Provisions shall be made for the increased forces induced on resisting elements of the structural system resulting from torsion due to eccentricity between the center of application of the lateral forces and the center of rigidity of the lateral force resisting system.
- c) Buildings and other structures shall be designed to sustain local damage with the structural system as a whole remaining stable and not being damaged to an extent disproportionate to the original local damage. This shall be achieved through an arrangement of the structural elements that provides stability to the entire structural system. This shall be accomplished by providing sufficient continuity, redundancy, or ductility, or a combination thereof, in the members of the structure.
- d) Where specific design codes, standards, and regulations are not noted, structural design shall be in accordance with US

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Army Corps of Engineers Technical Instructions and Technical Manuals. Material designs may be completed using the UBC in conjunction with the referenced organizations within. In case of conflicting requirements, the more stringent design criteria shall govern.

- e) The environmental conditions of the project location, including temperatures, shall be considered in the design of all structures.

#### 2.5.4 Design Loads

- a) Building Category: All buildings are classified as ordinary hazard facilities (ASCE 7 Category II). Importance factor for this classification is 1.0.
- b) Dead Loads: Dead loads will be according to the actual weight of materials. Weights of various building materials will be taken from applicable tables of ASCE 7. Actual weight of equipment, mechanical, electrical and piping shall be used in design of the supporting structure.
- c) Live Loads: Live loads will be according to requirements of ASCE 7. The following live loads are anticipated for these facilities:
  - a) Residential Living Areas - 1.92 kPa.
  - b) Ceiling Joist & Attic Space - 0.48 kPa.
- d) Snow Loads:
  - 1. Snow loads will be in accordance with ASCE 7 and CEPOA-EN-TE-ST criteria. Ground snow load will be 3.5 kPa. Minimum roof snow load will be 2.4 kPa.
  - 2. Drift loading and unbalanced loading will be in accordance with ASCE 7 requirements.
- e) Wind Loads: Wind loads per ASCE 7. Design wind speed (3 second gust) is 40 meters per second. Exposure is C.
- f) Seismic Loads:
  - 1. FTW is located in seismic probability zone 3 as defined by UBC and ASCE 7.
  - 2. Seismic loads shall be per UBC, 1997 edition or TI 809-4, Seismic Provisions for Buildings. Controlling lateral accelerations are as follows:
    - a)  $S_s = 1.12g$ .
    - b)  $S_1 = 0.31g$ .
  - 3. Seismic design using TI 809-4 includes more rigorous analysis requirements than those found in UBC or ASCE seismic codes. Designer should review the TI to become familiar with the analysis requirements. FEMA Recommended Provisions for the Development of Seismic Regulations for New Buildings, Part 1 - Provisions, Part 2 - Commentary includes similar design methodology and can be used as a resource.
  - 4. The dead load for seismic mass shall include 50% of

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the roof snow load.

g) Special Loads:

1. Utilidor lids and walls in traffic areas shall be designed to support AASHTO HS-20 traffic loads.
2. Design utilidors for exterior hydrostatic pressure (uplift) where they extend into the groundwater table.

h) Non-Structural Components: Non-structural components (mechanical and electrical equipment, piping, ductwork, lights, suspended ceilings, etc) shall be restrained against seismic loads. Industry standards may be utilized where allowed by code. For other elements, restraint shall be designed.

2.5.5 Concrete

- a) Structural concrete shall be in accordance with ACI 318, minimum 28-day compressive strength = 28 Mpa. The reinforcing of concrete walls, continuous footings, ties and bond beams shall be continuous and, therefore, typical details showing the arrangement of reinforcing at corners and intersections of these members shall be shown on the drawings.
- b) Concrete mix design shall be suitable for the site weather conditions. At a minimum, air entrainment will be 4 to 6 percent and water to cement ratio a maximum of 0.45.
- c) Reinforcing shall be bars. Welded wire fabric is prohibited in slabs on grade construction.

2.5.6 Reinforced Masonry

- a) Normal weight concrete masonry units, grade N-1, type S mortar, f'm = 10 MPa.
- b) Grout all cells above and below grade.
- c) Reinforcing steel per ASTM A615, Grade 60.

2.5.7 Steel

- a) Structural steel design and construction shall be in accordance with the American Institute of Steel Construction, Load & Resistance Factor Design. After erection, the field bolt heads and nuts, field welds, and any abrasions in the shop coat shall be cleaned and primed with paint of the same quality as that used for the shop coat.
- b) Structural steel shall conform to ASTM A36 or A572, sections and plates, ASTM A500, Grade B for tube sections.
- c) Shop connections for structural steel shall be welded and,

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in general, field connections will be made with high strength bolts, ASTM A325 bearing type connections. All connections shall be detailed on the final plans.

- d) Steel Joists shall be designed, fabricated and erected in accordance with Steel Joist Institute Standard Specifications and Load Tables.
- e) Steel stud wall systems may be used for interior non-bearing walls. Steel studs shall conform to the AISI specifications with galvanized finish.

#### 2.5.8 Wood

- a) Wood design and construction shall be in accordance with the Uniform Building Code (UBC), 1997 edition, and National Design Specification for Wood Construction, NDS-1997. Glue laminated lumber design and construction shall be in accordance with AITC Timber Construction Manual.
- b) Wood framing members shall be Hem-Fir #2 or better. Glue laminated members shall be Douglas-Fir combination 24F.
- c) Prefabricated wood I-joists or laminated veneer lumber shall be manufactured by an ICBO approved manufacturing facility. Prefabricated wood and metal press plate trusses shall be designed in accordance with Truss Plate Institute (TPI) documents and stamped by a professional engineer.
- d) Provide galvanized clips, hangers, and other connection devices, sized for the appropriate member and design load, to provide a positive connection of all framing members.
- e) Provide shop drawings for all framing members not fully designed and detailed on the construction drawings.

#### 2.5.9 Submittals

- a) Submittals shall be prepared by suppliers and submitted to the Contractor and engineer of record for review and approval. Provide copies of final approved submittals bearing the Contractor's and engineer of record's review stamps to the Corps of Engineers for information only in accordance with SECTION 01015 SPECIAL ITEMS.
- b) Shop drawings for fabrication, bending and placement of concrete reinforcement. Indicate grade of steel on shop drawings. Comply with ACI 315 "Manual of Standard Practice for Detailing Reinforced Concrete Structures" showing bar schedules, diagrams of bent bars, and arrangement of concrete reinforcement.
- c) Mix design for concrete, mortar, and grout. Testing for mix designs, using materials proposed for work in this project, shall have been performed not more than six months prior to placement of the mix in this project.

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- d) Shop drawings for structural steel, steel joists, and steel decking showing layout, including complete details and schedules. Show assembly for structural steel, joist types, and metal decking types. Drawings for steel joists shall be stamped by a registered engineer.
- e) Calculations for steel joists stamped by a registered engineer.

#### 2.5.10 Inspections and Tests

- a) Provide inspection and testing of structural materials and construction through independent test agencies and laboratories.
- b) Testing and inspection shall be specified by the structural engineer of record based on the design methods and materials used. At a minimum, inspection shall conform to the general inspection requirements identified in the Uniform Building Code, Section 108 and the Special Inspection requirements identified in the Uniform Building Code, Chapter 17.
- c) At a minimum, field quality assurance shall include sampling and testing of concrete during placement for temperature, air content, and slump. Strength test cylinders shall also be obtained.

#### 2.5.11 Force Protection

Force protection is required for buildings with respect to trash dumpster standoff distances, see Civil Design Requirements.

#### 2.5.12 Geotechnical

The Design-Build Contractor's Geotechnical Engineer of Record shall be responsible for preparing design recommendations for the foundation system for the buildings and site features. The foundation recommendation report shall be sealed by the engineer in responsible charge. The engineer shall be licensed as a civil engineer in the State of Alaska. A report, titled "Geotechnical Findings Report for the Family Housing Upgrade (FTW230), Ft. Wainwright, Alaska" dated March 2001 has been prepared for this project by the Government (see appendix 4). However, it is the Contractor's responsibility to provide any additional fieldwork deemed necessary.

#### 2.5.13 Acceptable Building Systems

The following building systems are acceptable for this project, however other building systems meeting the requirements listed above and not specifically prohibited may be used.

1. Cast in place concrete or CMU foundations.
2. Concrete slabs on grade.
3. Wood stud bearing walls.
4. Glued-laminated post and beams.

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5. Wood structural panel shear walls.
6. Engineered wood product floor and roof joists.
7. Structural steel post and beams.
8. Engineered wood or metal trusses.

#### 2.5.14 Betterments

There are no structural Betterments referenced in paragraph 1.1 GENERAL REQUIREMENTS.

#### 2.5.15 Design/Build Contractor Innovations

All Design/Build Contractor innovations shall conform to the criteria outlined above.

#### 2.5.16 Prohibited Items

Items that do not meet the minimum requirements listed are not allowed for the structures of this project. Specific systems prohibited include:

1. Light gauge cold-formed stud bearing walls.
2. Pre-engineered metal building construction.
3. Metal strap lateral bracing system.
4. Slab on grade reinforcement shall be re-bar only. Welded wire fabric is not allowed.

### 2.6 MECHANICAL DESIGN REQUIREMENTS

#### 2.6.1 Summary

- a) These specifications and the Room Criteria Sheets constitute the basis for the building mechanical design and construction of the Ft Wainwright Family Housing Project. The Contractor may use alternative design solutions and materials that meet the technical performance criteria. The alternative design solutions must provide methods, materials, workmanship, and quality of installation equal to, or better than, the minimum requirements of this section. Use metric units for design and construction.
- b) Specific requirements listed herein take precedence over conflicting requirements in the referenced documents.

#### 2.6.2 Scope

- a) Design and furnish all construction documents, labor, materials, equipment, supervision of labor, and performance of all operations required to completely install satisfactorily operating mechanical and plumbing systems. Major items of work include, but are not limited to, the installation of the following systems:
- b) General Mechanical Materials and Methods.
  - 1) Plumbing.
  - 2) Building Steam Utility Connections.

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- 3) Hydronic (Glycol) Heating.
- 4) Ventilation Systems.
- 5) Controls and Instrumentation.
- 6) Mechanical Rooms.

#### 2.6.3 References

Code Reference and Industry Standards Criteria: The design and construction shall comply with the latest editions of the following guides and standards and local codes and ordinances. Military publications can be obtained at the website:  
<http://www.usace.army.mil>.

1. Uniform Building Code (UBC).
2. Air Moving and Conditioning Association (AMCA).
3. American Society of Heating, Refrigeration and Air Conditioning Engineers (ASHRAE).
4. American Gas Association (AGA).
5. American Society of Mechanical Engineers (ASME).
6. National Fire Protection Association (NFPA).
7. Uniform Plumbing Code (UPC).
8. American Society for Testing Materials (ASTM).
9. American Water Works Association (AWWA).
10. American Welding Society (AWS).
11. Hydraulic Institute (HI).
12. National Bureau of Standards (NBS).
13. National Electrical Code (NEC).
14. National Electrical Manufacturers Association (NEMA).
15. Underwriters' Laboratories, Inc. (UL). All equipment shall bear the UL label or equivalent from a nationally recognized testing agency acceptable to the authority having jurisdiction.
16. American National Standards Institute (ANSI).
17. Sheet Metal and Air Conditioning Contractors' National Association (SMACNA).
18. Uniform Mechanical Code (UMC).
19. Air-Conditioning and Refrigeration Institute (ARI).
20. Uniform Fire Code (UFC).
21. All base materials shall comply with standards of ASTM and ANSI.
22. Occupational Safety and Health Administration (OSHA).
23. Environmental Protection Agency (EPA).
24. National Environmental Balancing Bureau (NEBB).
25. MIL-HDBK-1008C Fire Protection for Facilities Engineering, Design and Construction.
26. Corps of Engineers Guide Specifications
27. State of Alaska, Department of Environmental Conservation Requirements.
28. Americans with Disabilities Act (ADA)

#### 2.6.4 General Mechanical Materials and Methods

- a) Design decisions will be based on life cycle cost determinations and the impact on productivity and operating efficiency of the functions of the facility. Studies of other analysis will be made to consider the life cycle cost of the facility to arrive at an economical cost that takes into consideration not only the initial construction costs,



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but also the operating and maintenance costs of the building and its associated impact on the mission performance over the anticipated life of the facility. Existing piping inside or under existing buildings shall not be reused.

- b) Full access for maintenance of mechanical equipment shall be provided. The area of structure where HVAC equipment is located and the equipment itself shall allow sufficient clearance for removing coils and filters without having to remove piping, structure, doors or other surrounding items. Access to all mechanical equipment shall be unhindered and a minimum of 1 m wide by 2 m high. Access shall not require crawling over or under structure, pipes or other items. Stairs with handrails shall be provided when equipment is located in a basement, on a roof or on a mezzanine greater than 400 mm above finished floor. Catwalks, operating platforms, ladders, and guardrails shall be provided where needed to provide reasonable access for maintenance of equipment located in any attics or suspended in high bay areas.
- c) Framed instructions laminated in plastic, including wiring, sequence of operations and control diagrams showing the complete layout of the entire system, shall be posted. Condensed operating instructions explaining preventive maintenance procedures, methods of checking the system for normal safe operation, and procedures for safely starting and stopping the system shall be prepared in typed form, framed as specified above for the wiring and control diagrams and posted beside the diagrams. The framed instructions shall be posted before acceptance testing of the systems.

#### 2.6.4.1 Operating and Maintenance Data

- a) Provide six (6) sets of each type of instructions, bound together in D-ring metal ringed hardcover binders with removable pages, with a typewritten index indicating location of items in the work. Any information not pertinent to this work shall be deleted or neatly and completely lined out. Binders shall be of capacity to allow a minimum of 20 percent expansion. Contractor shall provide 4 hours of training on controls including start up/shutdown and maintenance/calibration.
- b) O & M training shall be provided by the Contractor. A 95% submittal of corrected contract drawings indicating as-built conditions shall be submitted 15 calendar days prior to scheduled O & M training. Deficiencies found during O & M training shall be corrected by the Contractor and updated drawings shall be submitted no more than 15 days after completion of training.
- c) The Contractor shall prepare operating and maintenance instructions containing information to operate, prolong service life or replace parts of the work. Operating and maintenance data shall specifically include:

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1. List of all Contractors and subcontractors names, addresses and telephone numbers.
  2. List of all equipment and material manufacturers' local representatives and suppliers and their addresses and telephone numbers.
  3. Pipe identification schedules.
  4. Nameplate directory with a list of all equipment indicating designation, location of equipment, manufacturers' name, model number, serial number, electrical characteristics, primary control switch location and normal position of switch.
  5. Valve directory indicating valve number, size, location, function, service, type and normal position.
  6. Air and hydronic test and balance report.
- d) Equipment Literature: Literature shall be grouped together by system, i.e., plumbing, heat generation, etc. For all equipment, fixtures, devices, valves and specialties, provide the following:
1. Manufacturer's data sheets and cut sheets.
  2. Model and serial numbers.
  3. Capacity curves, charts and calculations.
  4. Electrical characteristics.
  5. Replacement parts list.
  6. As-built equipment piping diagrams.
  7. As-built equipment wiring diagrams.
  8. Manufacturer's instructions for operation and maintenance.
  9. Completely mark out on all literature sheets all non-applicable items.
  10. Where piping and wiring diagrams are not available from the manufacturer, they shall be produced by the Contractor.
  11. Control Drawings with terminals wire numbers and sequence of operations.
- e) For each system section, the Contractor shall produce and include a basic system narrative description. Each narrative shall be comprised of the following:
1. Brief system description, including sequence of operation.
  2. Basic system function discussion, including any interaction with other systems or components.
  3. Primary system preventive maintenance procedures.
  4. How to isolate all major components.
  5. How to drain, fill and vent liquid system.
  6. How to drain, clean and refill all tanks, pumps and tube bundles.
  7. How to clean coils and change air filters for air systems.
  8. Emergency shut-down procedures.
- f) Master Maintenance Schedule: List each item of equipment

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requiring inspection and maintenance, showing required component maintenance and the intervals when such inspection and maintenance shall be performed (daily, weekly, monthly, semi-annually, etc.). For each item, reference the page within the maintenance manual, where detailed manufacturer's maintenance instructions can be found.

#### 2.6.4.2 General Piping Minimum Requirements

The following items are typical for all piping installations.

- a) Close all openings in pipes with appropriate caps, plugs or covers during progress of the work to preclude introduction of undesirable materials or contaminants.
- b) Slope all pipe lines and provide low point drains, using hose end gate valves and high point vents, using specified automatic air vents.
- c) Provide valves and unions adjacent to all tanks and equipment for isolation and removal purposes. All valves shall be installed with stems vertical wherever possible, and in no case shall stems be oriented below horizontal. All automatic and manual valves shall be readily accessible.
- d) Ream ends of all pipe to full diameter free of burrs, nicks and sharp edges.
- e) Cut pipe accurately from measurements taken on the site. Springing or bending to fit on make up pipe will not be permitted.
- f) Bushings will not be permitted except on tanks and similar equipment. Close nipples will not be permitted.
- g) Reduction of pipe sizes shall be made with reducing tees or reducing fittings.
- h) All pipe lines except piping under slab on grade shall be installed parallel with building lines and as high as possible. Piping shall clear all doors, windows and other openings. Avoid all ducts, light fixtures and similar equipment and conceal in finished areas wherever possible.
- i) Piping shall be supported in a manner to prevent binding, undue swing and vibration transmission to the structure.
- j) Where multiple pipes are clustered and routed in parallel, use trapeze hangers.
- k) Threaded Joints: Apply Teflon tape to male equipment

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threads.

- l) Soldered Joints: Use Type 95/5 Tin-Antimony or an IAPMO approved, lead-free solder, for copper tubing.
- m) Ring gaskets, spiral wound with centering ring, shall be used with all flanges.
- n) Arrange piping along walls in horizontal groups, each group to be in one plane.
- o) All non-factory finished piping, insulated and non-insulated, and pipe/equipment supports shall be painted.
- p) Locate thermometers and gauges to permit observation by personnel standing on floor. Provide instrument cocks at pressure gauges.
- q) Provide insulating couplings, dielectric nipples or flanges to prevent electrolysis at dissimilar metal piping connections.
- r) Unions for copper piping shall be brass.
- s) Field check valves for packing and lubricant. Replace leaking packing.
- t) Install isolation and drain valves to be readily accessible from floor level. Do not install valves with stem pointing downward.
- u) Provide isolation valves near every mechanical equipment requiring service. Provide isolation valves at each housing unit, for hot and cold water supply, to isolate from the remainder of the building.
- v) Provide valves same size as line size. All ball valves shall be full port.
- w) Install swing checks and gravity closing lift checks in horizontal position.
- x) Provide gate blowdown valves and hose adapters at strainers, valves shall be the same size as strainer blowoff connection.
- y) Provide end caps at all hose adapters and drain down valves. Provide nickel or chrome-plated escutcheons on all pipes passing through walls, floors and ceilings in finished areas, and where piping is in corridors, closets or cabinets and subject to view when doors are open. Escutcheons shall cover the pipe sleeve and shall be set with screws or springs for holding plate in position.
- z) Design and install piping with provisions for

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expansion and contraction using expansion loops, swing or expansion joints where required. Provide for expansion and contraction in mains, risers, and runouts. Do not spring or force piping during installation.

- aa) Flush all piping systems with clear water. Operate valves and other system components; drain and sterilize domestic water systems in accordance with requirements of AWWA C601 entitled, "Disinfection of Mains," and the public health agency having jurisdiction.
- bb) Do not route any piping in exterior walls.
- cc) Test all piping systems before concealing piping. Before testing, isolate or remove all equipment from system that would be damaged by test pressure. Purge or bleed air from piping systems before performing hydrostatic testing. Perform hydrostatic or pneumatic tests on piping in accordance with the following schedule. Maintain pressure for at least 24 hours.

System	Test	Test
	Medium Pressure	
Heating Water	Water	1050 kPa
Domestic Water	Water	1050 kPa
Steam	Water	1050 kPa
Condensate	Water	1050 kPa
Soil and Waste	Water	30 kPa head or top of vent
Plumbing Vents	Water	30 kPa head or top of vent

#### 2.6.4.2 Pipe Sleeves

- a) Provide sleeves where pipes pass through walls, floors or ceilings. Sleeves in bearing walls, foundations, masonry or concrete walls and slabs shall be black steel pipe. All sleeves through frame or similar construction shall be 20 gauge galvanized sheet metal with edges turned 15 mm, installed flush with both sides of wall partition. All sleeves shall be flush with surfaces except mechanical rooms, basement floor and any wet floor area where seepage may occur. In such areas the sleeves shall project a minimum of 25 mm above floor.
- b) Size sleeves to allow 15 mm annular space between pipe insulation, or the bare pipe, and the pipe sleeve. The space between pipe and sleeve shall be filled with mineral wool or other non-combustible material to prevent passage of fire and smoke. The non-combustible material shall be caulked between pipe and sleeve at wall surface. The caulking shall have suitable smoke and flame retarding capabilities for the application as evidenced by U. L. testing and labeling.
- c) Where sleeves are installed in walls with high sound

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transmission loss or sleeve serves vibration isolated pipe, sufficient space shall be provided between pipe and sleeve and packed with multiple layers of high density sponge neoprene to reduce transmission of sound. Allow space on each side of opening and cover neoprene with non-combustible material and caulking, as required to seal opening in accordance with above requirements. Provide sound dampening sleeves at all mechanical rooms, fan room and Laundry-to-Bedroom penetrations.

- d) For piping passing through sleeves in areas containing floor drains and in waterproof construction, caulk annular space between pipe or pipe insulation and the enclosing sleeve to attain a watertight installation. Caulk and finish with sealing compound.
- e) Use "squeaker" plastic sleeves for all pipes penetrating studs, joists, and sheathing.

#### 2.6.5.4 Piping Hangers and Supports

- a) All piping within the confines of the building walls, shall be rigidly supported from the building structure by means of hangers or supports.
- b) Support piping to maintain required grading and pitching of lines, to prevent and/or dampen excessive vibration, to secure piping in place and prevent any undue stain on the connected equipment. Lateral support against earthquake induced forces shall be accomplished by positive attachments without consideration of friction.
- c) Arrange supports to provide for expansion and contraction. No drilling of structural members will be permitted. Hanger and supports shall have a minimum safety factor of 5, based upon ultimate tensile or compressive strength, as applicable of material used.
  - 1. Provide bracing to prevent lateral motion.
  - 2. Provide plastic coated hangers and supports for copper pipe.
  - 3. Provide galvanized hangers and supports for hot-dipped galvanized sprinkler piping.
  - 4. Do not support weight of piping from mechanical equipment, ductwork, pump flanges, coil connects, or piping of other trades and related items.
  - 5. Provide insulation shields between hanger or support and piping for insulated piping.
  - 6. Chain or straphangers "plumbers tape" will not be permitted.
  - 7. Support vertical lines at bases with riser clamps
  - 8. Provide trapeze type hangers for multiple parallel horizontal pipes.
  - 9. Do not bend pipe hanger rods to provide alignment of piping offset from overhead supports.
  - 10. Provide additional support for heavy valves, specialties, and sway bracing where required.

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Provide pipe guides, anchors and expansion joints for all heating, steam and condensate pipes, with one guide on each side of every expansion joint.

11. Remove rust from ferrous hanger equipment and rods, and apply one coat of rust inhibiting paint before, or immediately after, erection.
12. Pipe Hanger Schedule:

Pipe Size	Max. Hanger Spacing	Rod Size
15 mm to 20 mm	1500 mm	10 mm
25 mm	1600 mm	10 mm
32 mm to 50 mm	3000 mm	10 mm
65 mm to 75 mm	3000 mm	13 mm
100 mm to 150 mm	3000 mm	15 mm
200 mm to 300 mm	4250 mm	22 mm

#### 2.6.4.5 Piping Identification

- a) Contractor shall provide pipe markers that identify all piping, including domestic hot and cold water piping, with approved color coded adhesive bands that show fluid type, piping system identification and directional flow arrows.
- b) Piping identification label to be black letters not less than 50 mm high. Directional arrows to be black, not less than 50 mm long, on yellow background. Piping identification and directional arrows shall meet ANSI A13.1-81.
- c) Identify piping at approximately 5 m centers in all rooms, as well as in all the other spaces (such as shafts) in which piping may be viewed. There shall be at least one set of identifying bands per pipe in each space requiring identifying bands. In addition, the origination of each pipe main shall be further identified indicating the zone served.

#### 2.6.4.6 Valve Identification

- a) Identify valves in all areas with 50 mm x 100 mm identification tags installed on handwheels or stem with brass bead chain. Identification tags shall be engraved, indicating the service abbreviation, stating whether normally open (engraved on green) or normally closed (engraved on red). Install tags with brass jack chain on handwheel or stem.
- b) Service abbreviation shall match piping service identification label. In addition, each valve tag shall include a unique sequential identification number. Where valves are located above suspended ceilings, provide colored pin markers in ceiling tiles to allow location of valves.



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#### 2.6.4.7 Equipment Identification

- a) Manufacturer's nameplates shall be provided on all equipment identifying manufacturer's name, model number, size, capacity, and electrical characteristics. Leave manufacturer's nameplates clean and legible.
- b) Identify all equipment with engraved identification tags showing symbol number and service as shown on the concept drawings. Securely fasten identification tags to equipment.

#### 2.6.4.8 Identification Charts

Provide charts framed with glass or plastic front. Pipe identification chart shall list piping systems with symbol and color coding where applicable. Valve identification chart shall list valve model numbers and symbol for service corresponding to piping symbol. Mount identification charts in each mechanical area.

#### 2.6.4.9 Insulation

- a) All insulation materials, including linings, jackets, facings, wet or dry adhesives, and vapor barriers, shall meet requirements of NFPA 90A. Flame spread rating shall not exceed 25 and smoke developed rating shall not exceed 50, as defined in ASTM E84.
- b) Provide insulation on all hydronic heating, domestic water piping, steam and condensate piping systems. Insulation shall be fiberglass. Provide complete with vapor barrier permeability rating of  $1.149 \text{ ng/s-m}^2\text{-Pa}$ , and with a thermal conductivity of  $k=.036 \text{ W/m-K}$  at 38 degrees C mean temperature. Install aluminum jackets on steam and condensate pipe insulation.
- c) Provide PVC pipe fitting covers and seal ends of fiberglass insulation with mastic.
- d) Provide cold piping systems with a continuous vapor seal. No staples or pins are permitted on cold water piping system insulation.
- e) All non-factory finished fiberglass insulation shall be finished with glasscloth and two coats of mastic.
- f) Piping insulation shall be continuous at all hangers and supports with rigid inserts and sheet metal shields.
- g) Rigid Insulation Inserts for Pipe: Calcium silicate, or approved substitute, for installation between pipe and hanger. Provide cellular foam glass inserts for all cold piping systems. Insulation inserts shall be not less than 150 mm long for 40 mm to 65 mm pipe, and 225 mm long for 80 mm to 150 mm pipe; thickness equal to adjoining insulation.

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- h) Galvanized Metal Shields: 16 gauge for 80 mm and smaller pipe, and 14 gauge for 100 mm and larger; formed to fit the diameter of the insulation, extending up to the centerline of the pipe. Length equal to insulation hanger inserts.
- i) Hydronic Heating Piping: 40 mm pipe and smaller, 25 mm thick; 50 mm to 150 mm pipe, 40 mm thick.
  - 1. Domestic Hot, Cold, and Recirculating Piping: All pipe sizes, 25 mm thick.
  - 2. Steam and Condensate: All pipe sizes, 50 mm thick.
  - 3. Piping Subject to Freezing Ambient Temperatures: All pipe sizes, 40 mm thick.
- j) Plumbing vents: 1200 mm below roof insulation to termination above roof line, 25 mm thick.
- k) Ductwork Insulation: Provide exterior insulation on all outside air ductwork, outside air intake plenums, relief air discharge and 2 meters upstream of exhaust ductwork exterior outlets. Insulation shall be fiberglass with a  $k=0.035$  W/mK at 24 degrees C or better. All insulated ducts shall be covered with 50 mm of insulation with a factory applied vapor barrier and multipurpose FSK facing. All non-factory finished fiberglass insulation shall be finished with glass cloth embedded with 2 coats of mastic.
- l) Utilidor Mains and Building Branch Piping: Insulation for the steam and condensate return lines in manholes shall be calcium silicate with an aluminum jacket and aluminum bands. Insulation for the steam and condensate return lines in utilidors shall be fiberglass with a vapor barrier jacket and aluminum bands. The insulation within the manholes (i.e. calcium silicate insulation) shall be required to extend approximately 2 m into the utilidor. Valves shall be covered with removable valve blankets that are secured with nylon buckles and straps.
- m) Provide aluminum insulation jackets for piping in high abuse areas such as within Mechanical Rooms.

#### 2.6.4.10 Vibration Isolation

- a) Furnish and install vibration isolating mountings and hangers for all equipment having reciprocating or rotating parts and for any other equipment, piping, or vessels that produce or transmit objectionable vibrations, pulsations, or noises.
- b) Furnish vibration isolators in the proper load range for the weight of the equipment supported. The natural frequency of the isolator shall be one-third to one-fifth of the lowest vibration frequency of the equipment or system where the isolator is used. When the equipment is mounted on a structure that is not rigid, the resilient mounts shall provide deflection that is at least four times the dead load deflection of the supporting structure. Isolators shall be selected so that deflection of each

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isolator on a piece of equipment is essentially identical.

- c) Two nuts shall be provided on each bolt for equipment secured with cast in place, expansion or chemically bonded anchor bolts.
- d) All vibrating equipment and the interconnecting pipe and ductwork shall be isolated to eliminate the transmission of objectionable noise and vibration from the structure.
- e) Provide vibration hangars to support all piping and ductwork runs within the first 2 m nearest the connection to rotating equipment.
- f) Vibration mounting isolators sizes shall be determined by the isolator manufacturer and shall be installed in accordance with the manufacturer's instructions.
- g) All equipment shall be protected from corrosion. For products with protective coatings, specifications shall be written to require the products' corrosion protection bond to pass one of the industry standard adhesion tests.
- h) Provide flexible pipe connections to Garage unit heaters.

#### 2.6.5 Plumbing System

Provide a complete domestic water, and waste system designed and sized to serve all plumbing fixtures, and drains as described within this RFP and the room criteria sheets. Slope all slabs to drains.

##### 2.6.5.1 Design Criteria

- a) The domestic water and waste systems shall be designed, sized, constructed, tested, and inspected, in accordance with the most recent Uniform Plumbing Code and all City of Fairbanks local code amendments. Do not connect storm drain to sewer piping service.
- b) All domestic water piping shall be sized for a maximum pressure drop of 11.3 kPa/10 m of piping, and a maximum velocity of 0.5 m/s.
- c) Provide a hot water generator sized in accordance to the ASHRAE 1999 HVAC Applications Handbook, Service Water Heating. The domestic hot water supply temperature shall be set at 50 degrees C, adjustable.
- d) Provide gravity sewer systems only unless impossible due to sewer main elevation. Multiple sewer main connections are permissible, if deemed cost effective.
- e) Install a domestic service water meter with strainer and a three-valve, by-pass line.
- f) Floor drains shall be located at all low points of floors

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in Garages, Laundry Rooms, and Mechanical Rooms. Install drain such that top of strainer is below finished floor level. Provide accessible trap primers for all floor drains.

#### 2.6.5.2 Materials

- a) Domestic water piping shall be type L copper tubing conforming to ASTM B88 with ANSI B16.22 fittings. Solder shall conform to ASTM B32, 95-5 tin antimony or IAPMO approved lead free.
- b) Waste, drain, & vent piping shall be CISPI 301 cast iron no-hub with cast iron couplings. ABS pipe may be used above grade where pipe noise is not a concern. Horizontal piping over living areas shall be cast iron. For forced discharge mains, use DWV copper, Type L, with soldered joints, the same as domestic water piping.
- c) Isolation valves shall be all bronze ball type with a minimum Class 200 pressure rating.
- d) Provide plumbing fixtures as indicated in the Room Criteria Sheets. To the greatest extent possible, plumbing fixtures shall be from one manufacturer. All fixtures shall be institutional quality, suitable for residential application.
- e) Water closets and lavatories shall be vitreous china; all kitchen countertop sinks shall be of stainless steel construction.
- f) Bathtub shall be enameled cast iron. Provide fixtures and faucets complete with all required specialties, trim, supports, and related items.
- g) Provide manual flush valves, at all water closets.
- h) Provide low flow water conservation 0.14 L/s faucets, 6 Lpf water closets, and 0.16 L/s shower tempering valves.
- i) Provide stops and escutcheons on all piping connections to fixtures. Provide integral stops on all shower valves.
- j) Furnish chrome plated adjustable cast brass P-trap with tubing drain to wall. Size to match tailpiece with chrome plated escutcheon.
- k) If gravity drainage is impossible, provide duplex, heavy-duty sewage ejectors with epoxy coated steel sump, duplex wet pit non-clog vertical column grinder pumps, non-slam check valves, and factory control panels with all relays and contacts as required including a hard-wired local alarm light and exterior-mounted rotating beacon.
- l) Water heaters shall be semi-instantaneous with double wall self-cleaning steam coils. Furnish and install heater

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units, with electric controls. Steam water heaters shall operate at 100 kPa steam, or lower, with a supply design temperature of 50 degrees C, adjustable. Tube bundle shall be readily accessible without removing heater, shell, or foundation.

- m) Exterior hose bibbs shall be frost-free type with integral vacuum breaker.

#### 2.6.5.3 Minimum Basic Requirements

- a) Each domestic water branch pipe shall be controlled by a ball valve where it connects to the supply main or riser. Each toilet room, group of fixtures, or isolated fixture shall be separately controlled by valves in an accessible location and provided with access doors where necessary.
- b) At all fixtures except water closets, install and connect hot water on left and cold water on right, as viewed when facing the fixture.
- c) Install capped air chambers at water connections to non-shock producing fixtures. Air chambers same piping size as fixture connection and not less than 400 mm long. Install water hammer arresters at water connections to shock-producing fixtures and plumbing groups with flush valves or solenoid valves. Water hammer arresters to be sized and installed per Plumbing and Drainage Institute Standards.
- d) All domestic hot water systems shall have a recirculating system, piped from each farthest fixture on a supply loop. Pumps shall be lead free, and plug cord wired; not hard wired.
- e) Slope all domestic hot and cold water lines, and provide low point drains to facilitate the complete drain down of the building.
- f) Pitch underground cast iron pipe within the building a minimum of 20 mm/m in the direction of flow. Make changes in direction of drainage lines with 45 degree wyes, long turn wyes, or sweep bends. Use long turn fittings wherever space conditions permit. Provide waterproofing around all lines penetrating through foundation walls and floor slabs.
- g) Provide cleanouts at the base of each stack, each change in direction, and on a minimum of 15 m centers at horizontal runs. Cleaning screws, deck plates, and other plugs shall be made up with graphite and oil only; use no grease or cement.
- h) Pitch plumbing vent lines to allow for drainage of condensation; terminate vents 600 mm above the roof.
- i) Encapsulate all exposed P-Traps, angle stops, and supply piping, located under handicap accessible lavatories and sinks, with fire resistant, molded foam, insulation per ADA

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requirements.

- j) Traps, valves, water hammer arresters, and automatic devices in concealed piping shall be provided with access doors. The doors shall be plastic or stainless steel for toilets and prime-coated steel or plastic for painted areas. Provide U. L. rated access doors to match wall construction rating.
- k) Insulate and heat trace 1200 mm upstream of rainwater and overflow leaders immediately after the roof drains.
- l) Locate exterior hose bibbs through mud sills if there are basements. Provide bibbs with threaded connection and isolation valve installed in accessible location.
- m) Provide access for replacement of tub drain-waste and overflow assemblies. Coordinate tub location/orientation to allow access panel to be placed in concealed location such as closets. Access panel shall be 12 inch by 12 inch minimum.
- n) Provide clean-outs at base of waste-drain risers, orient vertical, not horizontal.
- o) Provide hot and cold water hose bibbs with vacuum breakers in Mechanical Rooms.
- p) Provide nutating disc water meters for each water service, with three-valve maintenance bypass.

#### 2.6.6 Steam Utility Supply

Provide a complete steam service connection from the base utility steam mains that includes steam and condensate mains as described within this RFP and the Room Criteria Sheets. The central heating source for the facility is the base steam distribution system located in utilidors. Steam is available at approximately 560 kPa. The steam shall be reduced within the building mechanical room to a maximum of 100 kPa for use in heating. The system shall be sized and designed to serve the new facility, single capacity steam pressure reducing station 580 to 100 kPa with globe valve bypass, steam-to-glycol shell and tube heat exchanger with single steam control valve with globe valve bypass, and condensate receiver. System shall include all traps, anchors, expansion joints, strainers and appurtenances required to extend steam and condensate to the new building.

##### 2.6.6.1 Design Criteria

- a) High pressure steam utility mains shall be designed and sized for a maximum steam velocity of 60 m/s and 4.5 kPa/10m pressure drop. Low pressure steam distribution within the mechanical room shall be designed and sized with a maximum steam velocity of 40 m/s.
- b) Shell and tube heat exchanger shall be selected with a

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.0003 fouling factor and 1.2 safety factor, 100 kPa low pressure steam on the shell side and 90 degrees C, 50/50 propylene glycol/water on the tube side. Provide unit with float and thermostatic trap sized to handle 3 times the heat exchanger capacity for system warm-up.

- c) Pumped condensate utility mains shall be sized for a pressure drop of 2.3 kPa/10 m, and 3 times the total steam demand.

#### 2.6.6.2 Material

- a) Steam and condensate piping shall be ASTM A-53, grade B, carbon steel with welded or flanged type fittings equal and comparable to the piping. All steam piping shall be schedule 40 and condensate piping shall be schedule 80 with fittings to match. All nipples shall be schedule 80; close nipples are prohibited. All steam and condensate piping shall have expansion joints. All piping in inaccessible areas of utiliducts shall be welded only, regardless of pipe size.
- b) Steam valves 50 mm and smaller shall be steel. Steam valves over 50 mm shall be cast steel. All steam valves shall be 300 pressure class. Condensate valves shall be all steel gate type 200 SWP/400 WOG.
- c) Heat exchangers shall be horizontal U-tube type with removable tube bundle. Shell shall be welded steel with cast iron bonnet and 20 mm copper tubes. Heat exchanger shall be designed for 1000 kPa and shall bear the ASME "U" symbol. Provide unit with factory full-size ASME relief valve and vacuum breaker.
- d) Steam regulator valves for pressure control shall be pilot-actuated, diaphragm-operated type. The main valve body shall be cast steel, with stainless steel trim and a single seat construction. Pilot valve shall be bolted to the main valve body. Valve shall be rated for 2000 kPa MAWP at 230 degrees C.
- e) Expansion joints for steam and for condensate shall be slip type, injection packed.
- f) Condensate pumps shall be steam operated. Motive steam shall be 170 - 240 kPa. A pump failure shall signal an alarm. Condensate pumps shall be sized to insure that the equipment served provides a sufficient head for operation. A pressure gauge with full flow gate valves on either side shall be installed on the discharge line of the condensate pump. Unit shall be provided with 3/4 inch drain, and manufacturers integral insulation jacket. Unit shall be readily accessible for maintenance.
- g) Provide spiral wound lead faced gaskets for all steam and condensate flanged connections.



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2.6.6.3 Minimum Basic Requirements

- a) Provide and perform welding of pressure piping systems in accordance with provisions of all applicable codes, including ASME Boiler and Pressure Vessel Code, and ANSI/ASME B31 Series, Code for Pressure Piping. Qualify welding procedures, welders, and operators in accordance with ANSI/ASME B31.1, Paragraph 127.5, for shop and project site welding of piping work.
- b) All changes in direction and intersections in piping shall be made with welded fittings. Mitering of pipe to form elbows, notching straight runs to form tees or any similar construction will not be permitted.
- c) Slope all steam and condensate piping 10 mm/m in the direction of flow.
- d) Weld-O-Lets and Thread-O-Lets may be used on branch piping 50 mm and smaller connecting to mains over 100 mm. Branch pipe over 50 mm shall use welded fittings.
- e) Install strainers, isolation valves and eccentric reducers at all steam temperature and pressure regulator valves. Install a globe valve by-pass at each steam pressure reducing station.
- f) Valves for steam/condensate service, drains and for trap assemblies shall be as close as possible to mains (steam or condensate main as applicable).
- g) Install steam drip legs and line traps at each low point and the end of line point of the steam line. A blowdown on the building steam service and strainer, located on the building side of the isolation valve, is required. Direct blowdown discharges to floor. Drip leg should be full size with blowdown valve on bottom, minimum 50 mm diameter, and condensate drain valve no smaller than 40 mm diameter; also provide a drain valve, 40 mm diameter, on the condensate service isolation valve.
- h) Provide float and thermostatic traps for all low-pressure steam traps and bimetallic thermostatic traps for high pressure steam traps in utilidors. Never use bucket type traps. Size traps for 3 times the total steam demand.
- i) Provide all steam traps with isolation valves; strainer before and check valves after, unions on both sides, and test tee on discharge ahead of check valve.
- j) Provide all steam line strainers with blowdown valves, threaded hose connections and end caps.
- k) Traps shall be readily accessible.
- l) Pressure gauges shall be provided on each side of pressure reducing valves, heat exchangers and all isolation valves

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- within the utilidor. Pressure gauges on the discharge side of at each side of pumps shall be attached to the piping and not to the pump flanges. All pressure gauges shall be provided with isolation valves. Pressure gauges on steam lines shall be provided with "pig-tail" siphon snubbers. Pressure gauges on pumped condensate lines shall be provided with pin type pulsation snubbers.
- m) Thermometers shall be installed at all heat exchanger glycol inlets/outlets and hydronic system main supply/return.
  - n) Steam supplied to heat exchangers shall be 100 kPa or lower.
  - o) Flash tanks shall be installed on the discharge of all traps serving lines over 100 kPa.
  - p) Steam Traps
    1. Traps shall be located in a readily accessible location for maintenance with a union on each side of the trap.
    2. Traps shall be located 300 mm to 450 mm below steam coils outlets to provide adequate condensate head on the trap.
    3. A minimum 150 mm dirt leg shall be provided before the trap inlet.
    4. Traps shall be labeled with a 50 mm round/square numbered brass tag with stamped black-filled lettering, connected by a brass jack chain to the valve.
  - q) Strainers
    1. Strainers shall be provided upstream of steam traps, control valves, meters and pumps.
    2. Strainer housing shall be equipped with drain valves.
    3. Pressure reducing valves shall be configured in a 1/3-2/3 arrangement with the smaller valve opening fully before the larger valve begins to open. Smaller valve is the first to open and the last to close. Moisture elimination fittings shall be installed before pressure reducing valves. In addition, provide by-pass globe valves for PRV's and on heat exchanger steam inlet control valving.
  - r) All gasket materials shall be suitable for intended service; paper gaskets are not permitted.
  - s) Elevate heat exchanger and water heater to allow gravity drainage of condensate.
  - t) Provide separate vents for condensate receiver vent and steam pressure relief valve vent. Provide steam relief vent with drip pan elbow, with drain piped to floor drain. Route vents through roof. Coordinate locations of pipe and

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penetrations with rooms over the Mechanical rooms, and with fire rated partition per the UBC. Insulate vent piping and consider sound deadening.

- u) Provide unions at all equipment that requires maintenance including heat exchangers, control valves, pumps, and pressure relief valves. Locate union for relief valve close to valve outlet for quick valve removal. Provide wrench room around unions and flange bolts.
- v) Condensate meters shall be provided with three-valve bypass. Use nutating disc type meters.

#### 2.6.7 Hydronic (Glycol) Heating Systems

Provide a complete hydronic heating system designed and sized to serve all hydronic heating terminal units as described within this RFP and the Room Criteria Sheets. The system shall utilize a steam-to-glycol, shell-and-tube heat exchanger, with a glycol heating solution and duplex primary/secondary hydronic heating pumps for each zone. The perimeter building spaces shall be heated by perimeter baseboard radiation terminal units or in-floor radiant heating.

##### 2.6.7.1 Design Criteria

- a) The building heating system shall be designed to maintain an interior building temperature of 22 degrees C with a winter design temperature of -51 degrees C. DB. The building infiltration rate shall be based on the ASHRAE crack method with a 60 kph design wind speed. The minimum infiltration rate for entries shall be 1 air change per hour (AC/HR). The design heating load shall be calculated with a 1.2 safety factor for shell transmission losses and a 1.3 safety factor for infiltration losses. Design safety factors shall also be applied to the hydronic terminal units.
- b) All terminal units, and reheat coils shall be sized with a 10 degrees C hydronic fluid temperature drop. All terminal units shall be de-rated and selected for a glycol heating solution.
- c) All head loss calculations shall be corrected for a glycol solution and all hydronic heating pumps shall have a 1.2 safety factor. All hydronic heating piping shall be sized for a maximum pressure drop of 6.8 kPa/10m of piping.

##### 2.6.7.2 Materials

- a) Hydronic heating piping 80 mm and under shall be type L copper tubing conforming to ASTM B88 with ANSI B16.22 fittings. Solder shall conform to ASTM B32, 95-5 tin antimony or IAPMO approved lead free. Piping over 80 mm shall be ASTM A-53, grade B, carbon steel with welded or flanged type fittings equal and comparable to the piping.

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- b) The glycol shall contain corrosion inhibitors. The glycol shall be 50/50 propylene glycol corrosion inhibited fluid, factory premixed with de-ionized or distilled water. The solution shall be compatible with all wetted parts of the system.
- c) Valves shall be all bronze ball or gate type with a minimum 150 pressure class rating. Full port ball valves are acceptable for isolation.
- d) Pumps shall be maintenance-free, in-line, single stage, cast iron volute with stainless steel impellers and motor shaft. Each primary glycol circulation pump shall be provided with an alternate backup pump. The pump motors shall be high efficiency type motors. The primary and backup pumps shall be piped and valved so that one can be removed for maintenance and the other started, without a loss of service to the facility.
- e) All pumps shall be system-lubricated type where possible. Avoid canned rotor type.
- f) Circulating pumps and glycol make-up pumps shall have cord and plug wiring, not hard wiring to allow quick disconnect.
- g) Isolation valves and pressure gauges shall be installed on suction/discharge sides of pumps. Balance valves shall not be used as isolation valves.
- h) Pressure gauge ports shall be taken from piping, not pump flanges.
- i) Balancing valves shall be installed on the discharge side of all pumps. Triple duty valves shall not be used.
- j) Booster pumps shall not be isolated by control valves.
- k) Booster pumps shall have readily accessible disconnect switches.
- l) Remote booster pumps shall not be used.
- m) Pressure gauges and isolation valves shall be installed at the fill point and at circulating pump suctions/discharge.
- n) Flow measurement equipment shall be installed at all pumps.
- o) For glycol make-up, provide a jet pump with stainless steel components; plastic parts are not permitted.
- p) Baseboard finned tube radiation shall have architecturally styled enclosures with full back plates, copper tubing/aluminum finned elements, dampers, and 18 gauge enclosure construction.
- q) Heating coils shall be ARI 410 certified factory tested for 1400 kPa working pressure. Coils shall be aluminum finned

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copper tube construction. De-rate coils for use with glycol solution.

#### 2.6.7.3 Minimum Basic Requirements

- a) See steam system above for pipe welding requirements.
- b) Provide automatic air vents at all high points and hydronic terminal units. Air vents shall be Hoffman 79 or equal. Provide 15 mm isolation ball valves.
- c) Provide pressure gauges, thermometers, and Pete's plugs across heat exchangers, coils, and pumps.
- d) Prior to the completion and startup of the hydronic system, the glycol manufacturer shall test the glycol mixture in each independent system. The Contractor shall obtain from the glycol manufacturer written documentation of the type of chemical treatment to be applied and the recommended period of retesting and chemical reapplication. A copy of the treatment, retest schedule and reapplication schedule shall be included in the maintenance manuals.
- e) Provide optical hygrometer to Government to test glycol concentrations.
- f) After flushing and draining hydronic piping systems, circulate for a period of 6 hours a solution heated to 90 degrees C of 2.2 kg of tri-sodium phosphate for each 230 L of water in system. Upon completion, completely drain systems at all low points. Remove, clean, and replace strainer baskets. Refill system with a factory pre-mixed solution of glycol and water.
- g) Provide automatic glycol make-up system with a glycol make-up storage tank, make-up pump, pressure regulating valve, and pressure gage. Provide a three-valve manual by-pass for filling system.
- h) Provide balancing valves to regulate water flow through each piping loop, coils, terminal units and at other heating equipment and piping for proportioning flow.
- i) Heat exchangers, glycol make-up tank, floor-mounted pumps and other large equipment shall be mounted on minimum 100 mm high reinforced concrete housekeeping pads. The equipment locations shall be coordinated and arranged for optimum upright access, with at least 1 m wide by 2 m high free area around equipment.
- j) Pressure gauges shall be provided on each side of each pump, heating coil, heat exchanger and filter. Pressure gauges at each side of pumps shall be attached to the piping and not to the pump flanges. All pressure gauges shall be provided with isolation valves. Pressure gauges on glycol lines shall be provided with pin type pulsation snubbers. Temperature gauges shall be provided on each side of coils and heat exchangers.

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- k) Provide isolation valves on supply and return to each heating zone. Provide drain with hose thread outlet on the zone side of the return isolation valve. Provide isolation valves on both sides of zone valves.
- l) Hydronic piping systems shall be reverse-return systems.
- m) Balancing valves shall be installed on all bypass and return lines serving a 3-way control valve. Furnish a hydronic balancing meter for the project, compatible with the installed valves.
- n) Balancing valves shall not serve as an isolation valve anywhere in the system. Combination balancing/isolation valves shall not be used.

#### 2.6.8 Ventilation Systems

Provide a Mechanical Room ventilation system with tempered air and relief air. Provide exterior hoods Toilet rooms and Kitchen ranges shall have exhaust systems ducted to the exterior. Dryer exhaust ducts to exterior wall hoods are required.

##### 2.6.8.1 Design Criteria

- a) The ventilation system shall be sized, designed and installed in accordance with:
  - 1. ASHRAE Standards and Handbooks.
  - 2. 1995 SMACNA HVAC Duct Construction Standards.
  - 3. 1996 NFPA 90A Installation of Air-Conditioning and Ventilation System.
  - 4. 1997 Uniform Mechanical Code.
  - 5. 23rd Edition ACGIH Industrial Ventilation Handbook.
- b) The toilet rooms shall be exhausted at a rate of 10.3 L/s-m<sup>2</sup> or 10 AC/HR whichever is greatest.
- c) Low velocity ductwork will be sized by the equal friction or equal velocity methods. Louvers shall be sized for a maximum velocity of 2.5 m/s through the free area.

##### 2.6.8.2 Minimum Basic Requirements

- a) All ventilation equipment shall be installed on the warm side of the facility. No equipment shall be installed on the roof or require roof access for maintenance.
- b) All specified equipment shall be in mid-range of catalogued performance to allow for adjustment.
- c) All ductwork shall be hung, supported and installed in accordance with "Low Pressure Duct Construction Standards" of SMACNA. Ductwork shall be supported to prevent and/or dampen excessive vibrations and with full seismic bracing.

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- d) All fans shall be provided with sound lining or acoustical enclosures as required to meet the maximum acceptable sound power levels in each room.
- e) Rectangular elbows shall have double thickness, extended edge, turning vanes.
- f) Straight duct sections of at least 7.5 duct diameters shall be shown from fan discharge, elbows and open duct ends.
- g) All flexible ductwork shall be secured to the sheet metal collars or diffuser necks with nylon "zip strips". Trim excess strip and covered with duct tape. All flexible ducts shall be limited to a 1600 mm maximum length.
- h) Insulate all outside air ducts and plenums. Insulate all exhaust duct from the building exterior penetration to 1200 mm downstream of ductwork.
- i) All mechanical penetrations through exterior building surfaces shall be sealed weather tight i.e. brazed seams and joints. All wall penetrations shall be flashed, counter-flashed, and caulked.
- j) Seal all ductwork joints with SMACNA approved sealing system.
- k) Contractor shall provide sufficient advance notice before performing an air balance so that Base Engineering Team can be present to witness the procedure. Perform the air and hydronic balancing, testing and adjusting in conformance with American Air Balance Council (AABC) guidelines to achieve specified design values. Measure and record the NC-values for each room where a noise problem is suspected. Take measures to correct objectionable noise. Submit a complete report listing all the initial and final readings.
- l) Fans shall be provided with access to fan through fan guard. Access doors/panels shall be provided to reach areas needing periodic cleaning (i.e. reheat coils, motors, etc.)
- m) Do not route bathroom or dryer exhaust duct in cold attic or above the ceiling vapor barrier. Do not route exhausts through the roof.
- n) Bathroom and dryer exterior exhaust hoods (with backdraft dampers) shall be installed with sufficient vertical clearance from roof soffits to avoid moisture being drawn back in through the soffit vents and into the attic. Coordinate hood placement with window and door locations to provide adequate separation.
- o) Coordinate duct routing with ceiling joists and other structural members.
- p) Coordinate hood height with grade to avoid snow blockage.

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#### 2.6.9 Air Conditioning

No Air Conditioning is allowed.

#### 2.6.10 Controls

- a) The mechanical HVAC control system shall be an electric system.
- b) Zone valves shall be 24 VAC, normally closed type with manual override lever.
- c) Locate controls transformer in readily accessible location.
- d) Provide low temperature thermostat to shut down Mechanical Room ventilation fan.
- e) Provide outside air high temperature shut-down of circulation pump and heating system heat exchanger control valve.
- f) Provide heating glycol supply temperature reset based on outside air temperature. Reset schedule shall be adjustable.
- g) Glycol make-up pump shall be manually controlled. If pressure switch control is used, provide manual reset auto shut-off in case pressure drops 10 psi below setpoint. Use float switch and light for low level shut-off. Provide small bladder tank when providing automatic controls.

##### 2.6.10.1 Design Criteria

- a) Installer Qualifications: Company shall specialize in performing the work of this section with a minimum of three years documented experience.
- b) Provide complete operating systems including design, installation, testing, commissioning, and training.
- c) Provide a minimum of 2 hours of on-site operator training for each building to include, but not limited to, start-up, shutdown, maintenance, and calibration.
- d) Provide complete hydronic and ventilation system balancing in accordance with ASHRAE standards. Work shall be performed by a NEBB or AABC certified balancing company.

##### 2.6.10.2 Sequence of Operation

- a) Controls shall provide reset heating glycol supply temperature based on outside air temperature.
- b) High outside air temperature shall shut down the heating system pumps and steam control valves.
- c) Zone thermostats shall cycle space heating units on/off, to maintain the specified temperatures.



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2.6.11 Mechanical Rooms

2.6.11.1 Minimum Basic Requirements

- a) Mechanical room entrances shall be large enough to facilitate movement of large equipment to and from mechanical room. Double doors with separate access outside of facility are preferred.
- b) All framed walls within mechanical rooms shall be constructed using cement board. (i.e. no gypsum board).
- c) Hot and cold hose bib connections with vacuum breakers shall be provided in mechanical rooms.
- d) Mechanical rooms shall have a minimum of one floor drain, with trap primer. If a sump pump is required due to high sewer main elevation, the pump shall be capable of pumping high temperature condensate.
- e) Mechanical room floors shall slope to floor drains.
- f) Mechanical rooms with steam piping shall have nutating disc condensate meters and domestic water meters.
- g) 115 Volt power outlets shall be provided in mechanical rooms.
- h) Clearance shall be provided to remove, replace and maintain air filters, heat exchanger coils and hot water heating coils. All manufacturer recommended clearances shall also be provided.
- i) All access for maintenance shall be of an ergonomic design.
- j) All elevated units shall have catwalks and ladders to provide access.
- k) Inlet and exhaust openings for all facilities shall have hoods or louvers where they penetrate the exterior wall.
- l) Mechanical rooms shall be provided with ventilation allowing for a set temperature no higher than 27 degrees C.
- m) Mechanical room lighting shall be adequate for maintenance of all equipment.
- n) Mechanical rooms shall not be used a return plenums.
- o) Copies of the following drawings shall be laminated in clear plastic and placed in the mechanical room:
  - 1. Duct work drawings.
  - 2. Piping drawing.
  - 3. Valve schedule.
  - 4. Control schematics.

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5. Description of control operations.

2.6.12 Seismic Protection

- a) All mechanical piping, ductwork and equipment shall be seismically braced. Provide all necessary steel, hardware, devices and factory-manufactured components required for seismic protection of all mechanical equipment furnished under this contract.
- b) Design bracing and snubbers in accordance with Corps of Engineers Guide Specifications, SECTION 15070, SEISMIC PROTECTION FOR MECHANICAL EQUIPMENT. In particular, follow TI 809-04, "Seismic Design for Buildings," referenced in the stated document. The design shall also comply with AFM 88-3.
- c) Follow manufacturer's recommendations in selecting all factory-furnished devices.
- d) Submit an analysis of all required seismic control for evaluation and approval, as relating to mechanical equipment.
- e) Provide snubbers and flexible bracing as required for vibration isolation and earthquake protection. Use preferred factory-furnished equipment and devices to the extent feasible.

2.6.13 Preferred Items

- a) Faucets: Moen.
- b) Steam Hot water Heater: ace boiler Inc, Mini-Pack.
- c) Steam Control Valves: Sarco #25.
- d) Steam Pressure Reducing Valves: Sarco #25.
- e) Condensate Pumps: Watson McDaniel # PMPC.
- f) Zone Valves: Honeywell V8043A.
- g) Hydronic Pumps: Bell and Gossett series 90.
- h) Glycol make-up Pumps: Myers.

2.6.14 Betterments

The following Betterments referenced in paragraph 1.1 GENERAL REQUIREMENTS shall conform to the performance criteria above:

- a) Three-compartment kitchen sink.
- b) Additional vanity sink in bathrooms.

2.6.15 Design/Build Contractor Innovations

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Innovations shall conform to the performance criteria above.  
Care must be exercised to avoid stated prohibited items and to follow check-list criteria for preferred systems.

#### 2.6.16 Prohibited Items

Items, which do not meet the minimum requirements listed, are not allowed for the mechanical systems for this project. The following specific systems are prohibited for this project:

- a) Ozone Depleting Substances.
- b) Roof Mounted Equipment and any ductwork outside the building envelope.
- c) Dielectric Unions.
- d) Mono-flo and single pipe systems.
- e) Steam heating coils.
- f) Reheat energy for HVAC temperature control.
- g) Gravity relief air dampers.
- h) Automotive glycol and/or silicone-based inhibitors.
- i) Air Admittance Valves.

#### 2.7 ELECTRICAL DESIGN REQUIREMENTS

##### 2.7.1 Scope

- a) Furnish all labor, materials, equipment and supervision of labor for the complete and satisfactory design, construction and installation, but not limited to the following electrical systems:
  - 1. Lighting.
  - 2. Power.
  - 3. Telecommunication/Data System.
  - 4. Special Systems.
- b) Contractor and installers shall possess the following qualifications:
  - 1. Telecommunication/Data - BICSI certification
  - 2. Power and control wiring - Alaska electrician or lineman license as applicable.
  - 3. Electrical Contractor - Alaska Electrical Administrator's license.

##### 2.7.2 Basic Design Criteria of Electrical Systems

- a) Power system shall be completely designed in accordance with the latest edition of the NEC, NESC, and in accordance

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with the requirements herein.

- b) All plans shall bear the seal of an engineer registered in the State of Alaska as an electrical engineer.
- c) The design and construction shall comply with the latest editions of the following guides and standards and local codes and ordinances. Military publications can be obtained from at the web site: [www.usace.army.mil](http://www.usace.army.mil).

1. Military Handbook 1008C available at <http://w2.hnd.usace.army.mil/techinfo/milhbk.htm>.
2. ADA Accessibility Guidelines for Building and Facilities.
3. United States Department of Agriculture, Rural Utilities Service Criteria.
4. 2000 International Building Code (IBC).
5. Underwriters' Laboratories, Inc. (U.L.). All equipment shall bear the UL label, or equivalent, from a nationally recognized testing agency, acceptable to the authority having jurisdiction.
6. Illuminating Engineering Society (I.E.S.), Lighting Handbook, Ninth Edition.
7. National Electrical Safety Code (NESC).
8. EIA/TIA 570 Residential and Light Commercial Telecommunications Wiring Standard.
9. EIA/TIA 568A Commercial Building Telecommunications Wiring Standard.
10. EIA/TIA TSB 67 Transmission Performance Specifications for Field Testing of Unshielded Twisted Pair Cabling Systems.
11. IEEE STD 81 Guide for Measuring Earth Resistivity, Ground Impedance, and Earth Surface Potentials of a Ground System (Part 1).
12. NETA ATS - Accepting testing specifications for electronic power distribution equipment (International Electrical Testing Association)
13. NFPA 70, National Electrical Code.
14. NFPA 72, National Fire Alarm Code.
15. NFPA 101, Safety to Life from Fire in Buildings and Structures.
16. National Electrical Safety Code, ANSI C2.
17. Corps of Engineers Guide Specifications (CEGS).
18. Technical Manual, TM 5-8-11-1.
19. Technical Instruction, TI 800-01.

## 2.7.3 Basic Design Criteria

### 2.7.3.1 Exterior Lighting

- a) Exterior lighting is to consist of switched incandescent area lighting at building entrances as well as HPS area security lighting, controlled via photoelectric cells and contactors, around the building perimeters.
- b) Security lighting is to consist of reflector optics, cut-off type fixtures which minimize light trespass and glare. The fixtures are to be building mounted and shall provide a